

The Role of Self-Control Methods in Preventing Teenagers from Using Psychoactive Substances

Elena Mikhailova, Natalia Petrova, Anastasia Sergeeva

Elena Mikhailova and Natalia Petrova, Department of Psychology, University of Oulu, Oulu, Finland; Anastasia Sergeeva, School of Social Sciences, University of Edinburgh, Edinburgh, UK

Abstract. The article is devoted to the analysis of modern educational environment as potential resource to increase the effectiveness of biofeedback in order to prevent drug abuse among students. Substantiated educational environment is an approach to understand such biofeedback effectiveness. Biofeedback efficiency depends on the rate of return and the quality of information about the biological system. The advantages of biofeedback in comparison with other methods of self-regulation are discussed. The phases of biofeedback process are described as interconnected components of a single process that has become possible due to the hardware and software of educational environment. The features of different biofeedback instruments and psychophysiological specific training conditions are considered. The research allows to determine the effectiveness of work by biofeedback among teenagers. The results of forming experiment have statistically revealed a significant increase in the level of adolescent's self-control in the experimental group after the classes using biofeedback. Change of the attitude to drugs occurred only in the experimental group of adolescents who participated in the forming experiment.

The study received practical confirmation of the idea that the state of psychophysiological mechanisms with individual involvement in substance use can be objectively evaluated and managed by psychophysiological training aimed at improvement of self regulation effectiveness.

Аннотация. Статья посвящена анализу современной образовательной среды и ее потенциальных ресурсов, обеспечивающих повышение эффективности биологической обратной связи в профилактике употребления психоактивных веществ подростками. Проведенное исследование позволяет обосновать эффективность применения биологической обратной связи. В статье раскрываются преимущества биологической обратной связи по сравнению с другими методами саморегуляции. Рассмотрены этапы процесса биологической обратной связи, особенности различных видов биологической обратной связи. Исследование позволяет определить эффективность метода биологической обратной связи в профилактике. Результаты формирующего эксперимента статистически значимо показывают усиление самоконтроля подростков в экспериментальной группе после занятий с применением биологической обратной связи. В экспериментальной группе подростков произошло изменение отношения к наркотикам. Исследование подтверждает идеи о том, что состояние психофизиологических механизмов личностного противодействия вовлечению в употребление психоактивных веществ может объективно оцениваться и управляться в процессе психофизиологического тренинга с использованием метода биологической обратной связи.

physiological training, self-regulation, integration.



Ключевые слова: физиологический механизм, биологическая обратная связь, психоактивные вещества, психологический и физиологический тренинг, саморегуляция, интеграция.

Introduction

The aim of the study is to investigate the effectiveness of biofeedback in order to prevent substance use among teenagers. One of the central hypothesis of our study is the assumption that the educational environment, using special equipment for the registration of physiological parameters of the body can be regarded as one of the most appropriate mechanisms increasing the effectiveness of biofeedback in order to prevent substance abuse of teenagers. First, to prove this it is necessary to consider substantive characteristics of biofeedback. To prove this assumption it is necessary to characterize the phenomenon of a biofeedback. Jerrold S. Greenberg defines biofeedback as: "...the use of tools to reflect the psycho-physiological processes that cannot be realized by the man and proceed spontaneously" [1, p. 252]. Considering this definition we can say that biofeedback is a process in which a person learns to have a relative impact on the 2 types of physiological reactions: reactions which are not under arbitrary control and reactions that can be easily adjusted, but the process of regulation has been violated as a result of an injury or disease.

V.R. Bildanova, G.R. Shagivaleeva, O.M. Shterts indicated biofeedback principle as reflecting biological system efficiency which depends on the rate of return and the quality of information about system work. This law is valid at all functional levels [2, p. 26].

The process of biofeedback establishment includes some comparison between the identification of a person and bodily sensations and information about these feelings. Thus, teenagers have an opportunity to get signals corresponding to the functions of their body and identify what changes take place in the process of self-control [3, p. 47].

In fact, the biofeedback is a process including three main phases:

1. Measurement of the physiological parameter;
2. Transfer of measurement results into understandable form;
3. Feedback is a transmission of information to a person, training to control the processes in his body.

Material and research methods

Research allows to determine the biofeedback effectiveness in preventing drug abuse among teenagers. The following methods have been used in this research:

- a questionnaire "Styles of self-direction" (V. I. Morosanova).
- a questionnaire determining the adolescents' attitude to drugs use [4].
- various biofeedback methods of self-control.

While implementing the biofeedback method special equipment is used. It registers physiological parameters of the body, converts them into feedback signals that a person perceives in the form of sound or visual series. Biofeedback has a number of advantages. It is effective for treatment of anxiety and burnout, correction locus of control, regulation of mental state, various phobias and mood disorders. Such biofeedback methods and devices as Multiparameter Indicator "MiKarT", indicator "Wave" and the indicator "Term" are

widely used in order to prevent drug use. These methods are based on the biofeedback principle.

Biofeedback device "Wave" is one of the types of biofeedback software, which is used in psychological and educational prevention of drug abuse among teenagers. Using biofeedback device "Wave" teenagers learn to use diaphragmatic breathing as a method of self-regulation and correction of emotional and functional states. The main purpose of the "Wave" is to teach diaphragmatic breathing and to use it for optimization of the functional state of a person, giving favourable conditions to overall self-control development. The "Wave" provides cardio registration, its amplification, filtering from "noises" and converting into the digital signal. The amplified, "purified" and converted signal is sent to the computer and is displayed on the screen. A cardio-top box "Wave" uses bipolar cardio sensors, placed on the wrists of participants. Identification of the heart beat and determining the time of its arriving is carried out by the software.

There are several ways of breathing. Breathing under which the upper third of the sternum expands is called high rib breathing. This breathing occurs in situations of severe fright, high level of anxiety, but can also be chronic. It is better to use diaphragmatic breathing which helps to respond to stress immediately. Diaphragmatic breathing is the easiest and most effective way to regulate your state. Respiratory rate, physical and emotional stress are reduced because when breathing diaphragmatically the lungs get the most of oxygen.

Diaphragmatic breathing technique is associated with certain motor skills. Using this type of breathing it looks as if we are "breathing by stomach" and can observe its movements (when we inhale it goes up, "bellies", when we exhale it goes down). These movements are contractions of the diaphragm which carry out not passive but active exhalation that a person can learn to control.

According to the research made by A. N. Doletsky, I. V. Khvastunova, R. E. Akhundova, A. A. Migulin the successful relation of biofeedback with rhythmic breathing indicates the role of resonance processes. This allowed the authors to make a resonance hypothesis of relaxation according to which when the frequencies of changes of respiration, brain bioelectrical activity, heart rate and vascular tone agree, the increase of activity in resonant structures (thalamic pacemaker structures, the nuclei of the vasomotor and respiratory centre) take place [5, p. 19]. There are several modes of the feedback in the "Wave" program: "Column" Mode, "Line" Mode, "Slides" Mode, "Transparency" Mode and "Game Butterfly" Mode.

A temperature testing of testees is held with the help of the "Term" indicator. The use of the temperature biofeedback is based on the fact, that the peripheral temperature of the human skin reflects vasomotor function (expansion and contraction of blood vessels). When peripheral blood vessels are dilated, the flow of blood through them is increased and the skin becomes warmer. In case of extreme temperature measure it is possible to determine the degree of vasoconstriction (their contraction and expansion are regulated by sympathetic division of the autonomic nervous system), and measure the degree of sympathetic activity using indirect methods. Equipment used in temperature biofeedback consists of a sensor and a processor which sends information to the computer. A thermal measuring device is a termistor, which is usually attached to finger of a testee. Temperature biofeedback plays an important role in coping with stress because it is a good indicator of excitation of sympathetic

nervous system. The visual feedback in the "Term" is represented by different modes arranged in order of complexity: "Indicator" Mode, "Graph" Mode, "Rainbow" Mode and "Kaleidoscope" Mode.

Indicator "MiKarT" includes an indicator of muscle tension (IMT). Electromyograph device is used to organize such connection that allows adjusting the electrical impulses of the body by means of electrodes fixed on the human body. In the device the electric signal of the body is amplified and transformed into light or sound with intensity that corresponds to the intensity of the incoming signal. A man, taking these signals, gets information necessary for regulation of some function, for example, muscle strain. When a person perceives a threatening situation, certain muscle groups tense up in rather characteristic way. For example, the muscles of the back of the neck are tensed as if in an attempt to keep the head straight ("be vigilant"). Normally, such strain is slight and is not realized by the person. However, contraction of muscles can slowly build up until the muscle spasm. If you relax in time, the spasm will not take place, but it requires a conscious control of physiological processes. Electromyograph providing feedback allows to realize even even a small increase in muscle tension. Electromyographic biofeedback is used to improve condition of a person in stress and post-stress situations. It enables a person to learn to relax a particular muscle or muscle group (e.g., chewing muscles during teeth grinding). Thus, biofeedback is used to elicit a more generalized relaxation when the stress is influenced by the central mechanisms of nervous system.

To learn to relax and be stress resistant is possible using biofeedback and such devices as "Wave," "Term", "MiKarT". According to V. Y. Kotlyakovos' research, one of the main reasons for initiation of drug abuse by teenagers is a reduced ability to relax, to relieve discomfort by available means [6]. Help to relieve stress is one of central tasks in prevention of substance abuse by teenagers. Understanding of causes of drug addiction is crucial in planning and carrying out preventive work in the educational environment.

The study was conducted on the basis of the secondary school №112 (Samara, Russia) from February to May 2018. This school is located in one of the socially deprived areas in Samara. The drug use prevention program was approved by school administration, staff and parents. In general, this prevention program was also actively supported by municipal levels of Samara.

The study involved 46 pupils of 9 "A" and 9 "B" school classes. At the beginning experimental and control groups of teenagers were formed. While forming the groups, gender, social status were taken into account in each of them.

Thus, experimental group consisted of 20 adolescents. The biofeedback classes in the framework of the prevention of drug use were conducted in this group. 10 sessions of biofeedback devices were held in the experimental group of teenagers. Duration each session was 2-2,5 hours.

The control group consisted of 20 teenagers who didn't take part in the program of biofeedback method. Experiment results were processed in SPSS 15 in order to define the program efficiency.

Results and discussion

The results of behaviour regulation among teenagers before the experiment (see. Table 1).

Table 1.

THE RESULTS OF THE EXPERIMENTAL GROUP BEFORE EXPERIMENT WITH BIOFEEDBACK

<i>Result / Scales</i>	<i>Planning</i>	<i>Modeling</i>	<i>Design</i>	<i>Evaluation of results</i>	<i>Flexibility</i>	<i>Autonomy</i>	<i>Overall level of self-regulation</i>
Low level	20%	-	-	10%	-	5%	5%
Average level	75%	75%	55%	65%	65%	70%	70%
High level	10%	25%	45%	15%	35%	25%	25%

There obtained data of the experimental group of teenagers after experiment with biofeedback

(see. Table 2).

Table 2.

THE RESULTS OF THE EXPERIMENTAL GROUP AFTER EXPERIMENT WITH BIOFEEDBACK

<i>Result / Scales</i>	<i>Planning</i>	<i>Modeling</i>	<i>Design</i>	<i>Evaluation of results</i>	<i>Flexibility</i>	<i>Autonomy</i>	<i>Overall level of self-regulation</i>
Low level	20%	-	-%	-	-	-	-
Average level	50%	60%	45%	50%	45%	55%	45%
High level	30%	40%	55%	50%	55%	45%	55%

Wilcoxon criteria used in order to detect statistical differences in self-regulation among teenagers of experimental group before and after forming the experiment measured by the questionnaire "Styles of self-direction" [7]. Significant changes in planning before and after formative experiment in experimental group were found ($T=332$, $p \leq 0,05$). This suggests that in the experimental group conscious planning activities significantly increased. Plans of the experimental group of teenagers have become more realistic, detailed, hierarchical and stable.

Comparison of data of "Planning" scale among teenagers of control group showed no statistically significant differences ($T=441$, $p \geq 0,05$). Parameter of planning among teenagers of control group was poorly developed, the goals are subjected to frequent change, goals are rarely achieved, plans are unrealistic. The control group of teenagers still prefers not to think about future, puts forward situational goals.

The differences in parameter of "Modeling" in the experimental group before and after the experiment ($T = 319$, $p \leq 0,05$) were found. It means that teenagers of the experimental group were able to allocate significant parts of activity plan for achieving goals of both current and future situations after training with biofeedback.

In the control group there are no statistically significant differences in scale "Modeling" revealed before and after the experiment ($T=418$, $p \geq 0,05$). Thus, adolescents from the control group are characterized by low ability of modeling, which leads to inadequate assessment of important internal conditions and external circumstances. Control group teenagers also may have difficulty in determining goals and programs of action adequate to the current situation.

Significant difference in "Programming" before and after the experiment condition in the experimental group was found ($T=343$, $p \leq 0,05$). These differences show that teenagers have needs to think to compare their actions to achieve goals and programs of behaviour.

In the control group there were no significant differences in "Programming" between two measurements ($T=409$, $p \geq 0,05$). The control group teenagers still prefer to act impulsively; they cannot create their own programs of action, often face with a mismatch of the results and goals.

Also differences in "Evaluation of results" before and after the experiment in the experimental group were found ($T=282$, $p \leq 0,05$). Improved performance according to this scale indicates adequacy of subjective criteria of evaluating behaviour results of teenagers of the experimental group and their flexibility to adapt according changing conditions.

In the control group before and after the experiment there were no differences in "Evaluation results" ($T=424$, $p \geq 0,05$). The control group does not notice errors, which leads to increasing of workload.

There were significant differences in "flexibility" ($T=318$, $p \leq 0,05$) in the experimental group before and after the experiment. It indicates that after participating in the experiment the experimental group regulatory processes increased. In the event of unforeseen circumstances, such teenagers rearrange plans easily; they can assess changes in significant conditions quickly and restructure the program of action.

The control group showed no significant differences in "flexibility" ($T=428$, $p \geq 0,05$). As before, in dynamic, rapidly changing circumstances they feel insecure. They find it difficult to notice any changes in life, can't respond adequately to the situation, develop program of the action. As a result, the control group participants have regulatory failures in performing operations.

Also significant differences in "Autonomy" before and after the experiment in the experimental group were revealed ($T=335$, $p \leq 0,05$). It

shows that autonomy of the teenagers of the experimental group, their ability to plan their activity and behaviour, to organize work for reaching goals, to control the progress of their implementation, to analyse and evaluate both intermediate and final results of actions increased.

In the control group the results of teenagers on the scale of "independence" remained stable, there were no significant differences between the results of first and the final diagnosis on the given scale ($T=431$, $p \geq 0,05$). The control group teenagers were dependent on the opinions and evaluations of others; they uncritically followed someone else's advices. In the case they have no any help they may have regulatory failures.

Significant differences in "general level of self-regulation" before and after the experiment in the experimental group were revealed ($T=314$, $p \leq 0,05$). The experimental group teenagers became more independent, flexible to respond to changing conditions. Such adolescents compensate influence of personality, character traits preventing the achievement of the goals with selfregulation.

There were no differences in data of "general level of self-control" scale in the control group before and after the experiment ($T=401$, $p \geq 0,05$). The control group teenagers didn't have a need of conscious planning and programming of their behaviour, they were more dependent on the situation and opinion of the others, their ability to compensate adverse personality characteristics to achieve goals left low.

Questionnaire determining the teenagers' attitude to drugs in the control and experimental groups was used. Processing of the questionnaire produced the following results.

In the experimental group, the number of teenagers who showed negative attitude towards drugs increased. The results of the responses in the experimental group were close to the maximum of 70 points in terms of the negative attitude to drugs. The results of the test in the control group of teenagers are close to average of 45 points. It indicates unformed attitudes to drugs and the presence of teenagers with a predominance of positive attitudes to drugs over the negative in the group.

To identify differences in the level of attitude to drugs in the experimental group before and after the formative experiment Wilcoxon criteria was used ($T=117$, where $p \leq 0,05$). Consequently, there are differences between attitudes towards drugs among teenagers of the experimental group.

In the control group there are no any significant differences between attitudes to drugs before and after ($T=422$, where $p \geq 0,05$). It means that a change of the attitude to drugs was only in the experimental group

participated in the forming experiment to study the effectiveness of biofeedback in the prevention of substance abuse. In the control group there was no any change in attitude to drugs.

Conclusions

Thus, forming experiment was aimed at studying of biofeedback effectiveness in the prevention of substance abuse by teenagers. A significant increase of the level of self-control in the experimental groups after biofeedback experiment was shown statistically. This suggests that biofeedback is effective and activity of increasing the level of self-control is one of the key problems often leading to substance abuse by teenagers.

In general, during processing of the results of the formative experiment it was found that before and after the formative experiment there were significant differences in all diagnosed indicators of self-regulation and attitudes towards drugs among adolescents of the experimental and control groups.

It means that biofeedback is effective in the prevention of drug use by teenagers, primarily due to the efficiency of the work on improving of self-regulation and changing their attitude to drugs.

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